

# Computer Programs

## Electronic Systems

### Software for Remote Monitoring of Space-Station Payloads

Telescience Resource Kit (TReK) is a suite of application programs that enable geographically dispersed users to monitor scientific payloads aboard the International Space Station (ISS). TReK provides local ground support services that can simultaneously receive, process, record, playback, and display data from multiple sources. TReK also provides interfaces to use the remote services provided by the Payload Operations Integration Center which manages all ISS payloads. An application programming interface (API) allows for payload users to gain access to all data processed by TReK and allows payload-specific tools and programs to be built or integrated with TReK. Used in conjunction with other ISS-provided tools, TReK provides the ability to integrate payloads with the operational ground system early in the lifecycle. This reduces the potential for operational problems and provides "cradle-to-grave" end-to-end operations. TReK contains user guides and self-paced tutorials along with training applications to allow the user to become familiar with the system.

*This program was written by Michelle Schneider, Jeff Lippincott, Steve Chubb, Jimmy Whitaker, Robert Gillis, Donna Sellers, Chris Sims, and James Rice of Marshall Space Flight Center. Further information is contained in a TSP [see page 1].*  
MFS-31792

### SpaceWire Driver Software for Special DSPs

A computer program provides a high-level C-language interface to electronics circuitry that controls a SpaceWire interface in a system based on a space qualified version of the ADSP-21020 digital signal processor (DSP). SpaceWire is a spacecraft-oriented standard for packet-switching data-communication networks that comprise nodes connected through bidirectional digital serial links that utilize low-voltage differential signaling (LVDS). The software is tailored to the SMCS-332 application-specific integrated circuit (ASIC) (also available as the TSS901E), which provides three high-speed (150 Mbps) serial point-to-point links compliant with the proposed Institute of

Electrical and Electronics Engineers (IEEE) Standard 1355.2 and equivalent European Space Agency (ESA) Standard ECSS-E-50-12. In the specific application of this software, the SpaceWire ASIC was combined with the DSP processor, memory, and control logic in a Multi-Chip Module DSP (MCM-DSP). The software is a collection of low-level driver routines that provide a simple message-passing application programming interface (API) for software running on the DSP. Routines are provided for interrupt-driven access to the two styles of interface provided by the SMCS: (1) the "word at a time" conventional host interface (HOCI); and (2) a higher performance "dual port memory" style interface (COMI).

*This program was written by Douglas Clark, James Lux, Kouji Nishimoto, and Minh Lang of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP [see page 1].*

*This software is available for commercial licensing. Please contact Don Hart of the California Institute of Technology at (818) 393-3425. Refer to NPO-30389.*

## Mechanics

### Solution-Adaptive Program for Computing 2D/Axi Viscous Flow

A computer program solves the Navier-Stokes equations governing the flow of a viscous, compressible fluid in an axisymmetric or two-dimensional (2D) setting. To obtain solutions more accurate than those generated by prior such programs that utilize regular and/or fixed computational meshes, this program utilizes unstructured (that is, irregular triangular) computational meshes that are automatically adapted to solutions. The adaptation can refine to regions of high change in gradient or can be driven by a novel residual minimization technique. Starting from an initial mesh and a corresponding data structure, the adaptation of the mesh is controlled by use of minimization functional. Other improvements over prior such programs include the following: (1) Boundary conditions are imposed weakly; that is, following initial specification of solution values at boundary nodes, these values are relaxed in time by means of the same formulations as those used for interior nodes. (2) Eigenvalues are limited in order to suppress

expansion shocks. (3) An upwind fluctuation-splitting distribution scheme applied to inviscid flux requires fewer operations and produces less artificial dissipation than does a finite-volume scheme, leading to greater accuracy of solutions.

*This program was written by William A. Wood of Langley Research Center. Further information is contained in a TSP [see page 1].*  
LAR-16431

## Machinery

### Software for Preprocessing Data From Rocket-Engine Tests

Three computer programs have been written to preprocess digitized outputs of sensors during rocket-engine tests at Stennis Space Center (SSC). The programs apply exclusively to the SSC "E" test-stand complex and utilize the SSC file format. The programs are the following:

- Engineering Units Generator (EUGEN) converts sensor-output-measurement data to engineering units. The inputs to EUGEN are raw binary test-data files, which include the voltage data, a list identifying the data channels, and time codes. EUGEN effects conversion by use of a file that contains calibration coefficients for each channel.
- QUICKLOOK enables immediate viewing of a few selected channels of data, in contradistinction to viewing only after post-test processing (which can take 30 minutes to several hours depending on the number of channels and other test parameters) of data from all channels. QUICKLOOK converts the selected data into a form in which they can be plotted in engineering units by use of Winplot (a free graphing program written by Rick Paris).
- EUPLOT provides a quick means for looking at data files generated by EUGEN without the necessity of relying on the PV-WAVE based plotting software.

*This program was written by Chiu-Fu Cheng of Lockheed Martin Corp. for Stennis Space Center.*

*Inquiries concerning rights for the commercial use of this invention should be addressed to the Intellectual Property Manager, Stennis Space Center [see page 1]. Refer to SSC-00151/53/60.*